REMARKS

Reconsideration of the objections and rejections stated in the Office action mailed March 8, 2006 is requested in view of the above amendments and following actions and comments.

§ 112 Rejections

Claims 11 and 12 have been canceled, which obviates the stated rejection.

§ 103 Rejections

1. Claims 2, 6, 8, 11-14, 16, 19-20 and 41-42 were rejected under 35 USC § 103(a) in Section 5 of the Office action as being unpatentable over U.S. Patent Publication 2002/0102897 to Berrigan et al. (hereafter Berrigan) in view of any one of USPN 4,692,371 to Morman et al., USPN 5635290 to Stopper et al. or USPN 5652051 to Shawver et al.

Reconsideration is requested in view of the following comments.

Correcting possible misunderstanding

In maintaining the stated rejection of the listed claims, the examiner essentially gave no weight to the reasons and explanations that applicants presented in their response submitted January 11, 2006. In these reasons applicants referred to oriented elastomeric fibers as having a "locked-in orientation," and as a first-stated ground for disregarding applicants' reasons it was stated that "the current claims do not mention a claimed 'locked-in' orientation" (Office action, page 9, lines 1-2).

The quoted statement from the Office action is not correct. Applicants' claim 1 recites that the fibers "have a molecular orientation sufficient to provide a birefringence number of at least 1×10^{-5}," and claims 2-5 and 19-20 call for a birefringence number of at least 1×10^{-2}. As stated in applicants' specification, page 2, lines 18-25, the existence of birefringence in fibers means that the fibers are oriented. And according to applicants' specification, among other places at page 2, lines 8-10, saying fibers are oriented is synonymous with saying the fibers have a locked-in orientation. When applicants' claims recite a birefringence number they are calling for locked-in orientation, i.e., a molecular orientation that is retained and present in the fiber of the web as claimed. Such a locked-in orientation – orientation that is retained and present in a dimensionally stable elastomeric web – is a major accomplishment, long sought after, but so far as known, never before obtained.

The other stated ground for disregarding applicants' reasons is that "Berrigan teaches that the distance from the die to the attenuator and the distance from the attenuator to the collector can be varied to obtain different effects" (Office action, page 9, lines 2-4). But such a generic statement of possibility does not teach applicants' present invention, which involves specific steps not at all addressed by the generic statement referred to.

Neither of the stated grounds is a valid reason for disregarding or overcoming applicants' showing of distinction over the cited references.

Challenge overcome by applicants' invention

The present invention achieves a result long sought but not known to have been previously obtained. There has been a desire for webs of oriented elastomeric meltspun (i.e., spunbond) fibers. One allusion to this desire is Gessner, U.S. Pat. 5,997,989 (of record), which states (col. 3, ll. 14-19; emphasis added):

> [I]t would be desirable to provide elastic nonwovens by spinbonding. Attempts to impart elasticity to spunbonded fabrics, however, have been largely unsuccessful.

Gessner does not teach elastomeric webs like applicants' webs, because Gessner does not attain true elastomeric properties, which as stated in applicants' claims (see applicants' claims 41 and 42) requires webs "that a) may be stretched at least twice their original length and, when released from tension stretching them to twice their original length, will promptly retract to no more than one-and-one-fourth times their original length." Gessner calls for 30% elongation instead of applicants' 100% elongation, and its recovery (70%) from even that low 30% elongation does not match applicants' recovery.

In addition, Gessner says nothing about dimensional stability. Dimensional stability is an important part of applicants' invention. A fibrous web without dimensional stability has only limited utility. So far as known, applicants' claimed web is the first ever dimensionally stable fibrous web comprising oriented elastomeric fibers.

The webs defined by applicants' claims are unique products, and despite many years of effort no one had taught how to make them.

Neither Berrigan nor any other known prior art teaches how to obtain applicants' new webs

In achieving their new unique products applicants make use of Berrigan's equipment and basic process, but applicants go beyond Berrigan in several important respects.

a. Applicants teach controlling the temperature at which extruded filaments enter an attenuator (e.g., by choosing the spacing between extruder and attenuator) so that i) the filaments are capable of being drawn for longer times in the attenuator and ii) the threadline stress applied to the filaments is lower and thus effective to stretch them without rupturing them; see applicants' specification, inter alia, paragraph bridging pages 7 and 8.

b. Applicants teach i) maintaining attenuating and drawing stress on extruded filaments until the filaments have cooled to their orientation-locking temperature; and ii) the orientation-locking temperature is generally at least about 30 °C less than the relaxation temperature (about T_g or T_M depending on the crystallinity of the material); see applicants' specification, inter alia, page 8, lines 17-28, and page 9, lines 3-10.

c. Applicants teach annealing fibers, with at least three specific aspects to the teaching: i) the fibers have locked-in orientation (i.e., they have been treated by the specific procedures of point (b) above); ii) the fibers are heated to a temperature between the relaxation temperature and the shrinking temperature of the fibers (see applicants' specification, inter alia, page 4, first paragraph, page 6, lines 13-23, and page 19, lines 3-6); and iii) preferably the fibers are treated before they are bonded into a web (see applicants' specification, page 6, lines 24-31).

d. Applicants teach applying the specific steps of points (a) - (c) to elastomeric fiber-forming materials, with the discovery that the steps are effective with elastomeric materials so as to form an oriented dimensionally stable elastomeric web; see applicants' specification at the places identified above as well as the paragraph bridging pages 2 and 3 and page 3, lines 15-23.

e. Applicants teach that a useful orientation is retained in elastomeric fibers that are attenuated, drawn and annealed as described in points (a) - (d) even after sufficient annealing to make the web dimensionally stable. See applicants' specification, inter alia, page 3, lines 8-14, page 6, lines 13-23, and the paragraph bridging pages 8 and 9.

The above list of teachings (a)-(e) are all specific new teachings not found in Berrigan or any other known prior art. By these steps applicants bring the art something it has sought but never before obtained.

Practical illustration of applicants' teachings

Applicants' working examples provide specific and practical illustrations of the teachings discussed above with respect to a variety of elastomeric fiber-forming materials. To illustrate how applicants' teachings differ in a practical way from the teachings of Berrigan, applicants' January 11, 2006 response compared Berrigan's Example 35 and applicants' Examples 1 and 2. These examples all deal with polyurethane. It was noted that the total distance of travel of filaments being processed (the distance of die to attenuator plus attenuator to collector, disregarding the length of the attenuator) in Berrigan's Example 35 was about 91 centimeters. By contrast, in applicants' Examples 1 and 2, that same distance was over 160 centimeters, which clearly is an implementation of the process steps (a)-(d) above. There also were other differences Between Berrigan's Example 35 and applicants' Examples 1 and 2, including that there was no annealing in Berrigan's example.

The comparison was just an illustration. The more substantive fact is that the teachings listed above are not taught in Berrigan. Applicants have gone beyond Berrigan by teaching procedural steps not taught in Berrigan and by achieving a result – a dimensionally stable elastomeric web – not taught in Berrigan or any other known prior art.

Secondary references

The secondary references Morman, Stopper and Shawver are cited for their disclosure of elastic fibers. However, the elastic fibers disclosed in these patents are meltblown fibers, which are known to be largely unoriented. See the attached excerpt from the *Encyclopedia of Polymer Science and Engineering*, John Wiley & Sons, Inc., 1987, Volume 10, page 240, line 4. Rather than leading to the oriented elastomeric fibers of applicants' invention, these references emphasize the challenge of preparing elastomeric fibers in oriented form.

In summary as to the rejection of Paragraph 5 of the Office action, the general statements in Berrigan are not equivalent to the specific teachings of (a) - (e) above. Nor do they teach that a particular narrow class of materials -- elastomeric materials, which have been a challenge to prepare as an oriented dimensionally stable fibrous web -- can be made into oriented fibers and made dimensionally stable by applicants' new process steps. Given the absence from the prior art of any existing dimensionally stable elastomeric web, it is clearly not an obvious matter to make such webs.

2. Claim 15 is rejected under 35 USC § 103(a) in Sections 6 and 8 of the Office action as being unpatentable over U.S. Patent Publication 2002/0102897 to Berrigan in view of any one of USPN 4692371 to Morman, USPN 5635290 to Stopper or USPN 5652051 to Shawver as applied to claims 2, 6, 8, 11-14, 16, 19-20 and 41-42 above and further in view of USPN 5714107 to Levy (combined in Section 8 with Yamamoto).

Levy is understood to be cited because of its reference to hydroentangling a web. Whatever its teaching on hydroentangling it is clear that Levy does not speak to or overcome the deficiencies noted above of the main references.

3. Claims 2, 6, 8, 11-14, 16, 19-20 and 41-42 are rejected under 35 USC § 103(a) in Section 7 of the Office action as being unpatentable over U.S. Patent Publication 2002/0102897 to Berrigan in view of any one of USPN 4692371 to Morman, USPN 5635290 to Stopper or USPN 5652051 to Shawver as applied to claims 2, 6, 8, 11-14, 16, 19-20 and 41-42 above, and further in view of USPN 3783649 to Yamamoto et al.

The only relevance of Yamamoto to applicants' invention appears to be the general statement in Yamamoto, column 1, lines 19-30:

> ... when fibers ... are subjected to heat-treatment such as stretching, relaxation, annealing, etc., ... the qualities of the fibers are improved, for example ... shrinkage is reduced and stabilized as well as made uniform ... .

Applicants recognize that annealing fibers is not new; but no prior art known to applicants teaches preparing elastomeric fibers that [(1)]are oriented and [(2)]have a locked-in orientation such that they can be annealed to a state of dimensional stability and remain oriented, and [(3)]are annealed by applicants' annealing conditions, e.g., use applicants' temperature ranges. The prior art discussed above – e.g., Gessner – indicates that obtaining such a product is a challenge. Yamamoto does not teach how to do it, and has at least three fundamental deficiencies:

a. Yamamoto does not make any teachings about elastomeric fibers as taught in Berrigan;

b. Yamamoto's annealing method could not be used with Berrigan's method of fiber preparation; and

c. Yamamoto teaches no details such as the temperature range of annealing used by applicants.

Yamamoto is directed to apparatus for heat-treating fibrous material in a pressurized fluid such as steam heated and pressurized above atmospheric pressure (Yamamoto, col. 1, ll. 5-17). The heat treatment is performed while the fibers are being held under tension by rollers (see Yamamoto, column 5, lines 22-31). Also, the heat treatment is performed while the fibers are in a pressurized chamber. The chamber has inlet and outlet nozzles through which the fibers enter and leave the chamber. Such teachings are clearly not applicable to the fiber-preparation method taught by Berrigan, in which filaments are passed through an attenuating chamber in an air stream. There is no description in Yamamoto of the materials being treated; nor is there any description of the effect Yamamoto's treatment might have on fibers of a particular material. Yamamoto's teachings are remote from Berrigan and cannot suggest a modification of Berrigan's method and product to arrive at applicants' invention.

In view of the above, it is submitted that the application is in condition for allowance. Reconsideration of the application is requested.

Respectfully submitted,

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Date

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surface available for bonding is converted to fused, compacted areas of bonding. Optimum conditions of pressure and temperature depend on many variables, including the nature of the web, line speed, and the engraved pattern. Even subtle changes can result in significant changes in the final product (43).

Since engraved-point-bonding rolls can be as wide as 5 m, the problem of maintaining uniform pressure across the width must be addressed. Small differences in pressure across the width can produce unacceptable variations. The hydraulic pressure applied at the ends of the roll results in a slight deflection, ie, less pressure is applied in the center than at the ends. This problem can be solved in various ways (43), most commonly by cambering, wherein the roll diameter decreases slightly from the center to the ends.

For spunbonded fabrics, chemical-binder bonding is used less frequently than thermal bonding; the reverse is true for staple-fiber nonwovens. Resin binders achieve special characteristics on spunbonded webs that cannot be attained thermally (44). In a typical procedure acrylic resins are applied to saturate the web; excess resin is removed by nip rolls and the wet web is passed through a drying oven to remove excess water and cure the resin which tends to concentrate at fiber–fiber junctions. Resin binders may instead be applied in discrete points in a pattern in order to immobilize fewer fibers and produce a softer fabric. However, it is difficult to control resin diffusion; the drying step is a disadvantage.

Chemical bonding with hydrogen chloride gas has been used with spun webs of nylon-6,6 to produce spunbonded nylon fabrics (45). In this unusual process the activating hydrogen chloride gas is passed over web fibers held in close contact by tension. The HCl gas ruptures the hydrogen bonds between the polymer chains and forms a complex with the amide group. Desorption of the gas reverses the process, and new hydrogen bonds are formed between polymer chains in different fibers. This method has been refined further to permit only pattern bonds to be formed, whereby fiber mobility is retained between the bonded areas, conferring a softer hand to the bonded fabric (46).

Certain generalizations apply to web bonding. If the web is highly bonded, most fibers are bonded to another fiber. The resulting structure is stiff and paperlike with high tensile and modulus properties but low tear resistance. On the other hand, if the web is only slightly bonded, fewer fiber-to-fiber bonds are present, and the structure is softer with lower tensile and modulus properties but higher resistance to tear propagation; surface-abrasion resistance is also low. Point bonding affords a greater variety of structures than area bonding because of the almost endless variety of available bonding-roll patterns. However, because of the high cost of the bonder roll, only one or two patterns are selected.

Meltblown Fabrics

The fibers of meltblown fabrics are composed of discontinuous filaments and are smaller than those of spunbonded fabrics. Although meltblown fabrics are not generally referred to as spunbonded because of discontinuous filaments, the integration of spinning, attenuation, laydown, and bonding during the production of meltblown webs describes a process traditionally defined as spunbonding. Fi-

bers produced by melt blowing are very fine with a typical diameter of 3 μm (47,48), which is smaller by an order of magnitude than the smallest traditional spunbonded fiber. The webs are weak and easily distorted, since the fibers are extremely fine and largely unoriented. Most commercial products are made of polyester or high melt-flow polypropylene, but other thermoplastic polymers have been used.

The term meltblown is descriptive of the process used to produce these fibers. A special die uses heated, pressurized air to attenuate the molten polymer filament as it leaves the orifice of the dye or nozzle (Fig. 10). Air temperatures range from 260 to 480°C with flow rates of 1.4–7 kg/min per cm^2 of slot area (49).

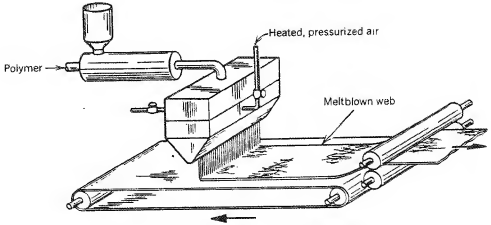

Fig. 10. Typical meltblown process.

The rapidly moving hot air greatly attenuates the fibers as they leave the orifices, creating the subdenier size. The weak discontinuous fibers are deposited on the forming screen as a random, entangled web which may be thermally point bonded to improve strength and appearance. The web may also be deposited onto a conventional spun but not bonded web to which it is then thermally bonded. Sandwich structures have been created with the meltblown web between two conventional spunbonded webs (50). Other materials eg, cellulosics, have been blended into the meltblown filament stream to yield a meltblown structure with a unique combination of properties (51). Mixtures of meltblown fibers and crimped bulking fibers are sold as thin thermal insulation for outdoor clothing and gear (52). Meltblown technology has been adapted to produce nontraditional spunbonded fabrics (21).

The great quantity of very fine fibers in a meltblown web results in unique properties, such as very large surface areas and very small pore sizes. These materials are used for hospital gowns, sterile wrappings, incontinence devices, oil absorbers, battery separators, and special filters. Many new composite structures are expected to be designed from meltblown webs.